

Revised New Grade 5 Science Standards

Revision by Michael A. Clarke Ph.D. and Terry Hufford Ph.D. of the rearticulated standards adopted by the State Board of Education,
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Grade 5 Science: Preamble

Scientific Thinking and Inquiry, Science and Technology, Earth Science, Physical Science, and Life Science remain the fundamental principles of this rearticulation.

Scientific progress is made by asking relevant questions, conducting careful investigations, **and drawing appropriate inferences based on those investigations**. As a basis for understanding this concept, and to address the content in this grade, students should have the opportunity to develop their own questions.

As part of the scientific process, students should have the opportunity to experiment, investigate, and problem solve and should keep a notebook to record **methodology**, observations, **and data**.

Other activities should be encouraged to develop a sound understanding of content.

Students should observe:

- (a) Stars, **planets, satellites, and other celestial bodies by either visiting an observatory or a planetarium**. Discussion of observable peculiarities and characteristics should be **encouraged**.
- (b) **Some organisms, consisting of a single cell, interacting with the environment in various ways**.
- (c) Some organisms are made of a collection **of cells that interact with each other in various ways**.

Students should investigate:

- (a) That when liquid water evaporates, it turns into a gas (vapor) mixed into the air, and **upon cooling** can condense and reappear as a liquid. When cooled **below its freezing point it appears as a solid (ice)**. [No explicit treatment of sublimation is required at this level.]
- (b) That heating and cooling cause changes in the properties of substances; for example see (a) above.
- (c) How some materials conduct heat much better than others, and poor conductors (insulators) can be used to reduce heat loss or gain. **[Examples using ice and hot water in insulated and non-insulated cups at room temperature monitoring time for melting or temperature changes would be experimentally appropriate.]**
- (d) That unbalanced forces cause changes in the speed and/or direction of motion of an object (acceleration). **[For example students should have the opportunity to use spring**

balances to investigate the effects of balanced and unbalanced tensions applied to inanimate objects.]

(e) That the greater the net force, F , applied to a body, the greater its acceleration, a . [Familiarity and play with bat and ball games can be used to enhance this concept.]

Strand 1	Science and Technology
Standard 1 Scientific Thinking	Students should be encouraged to think scientifically: as a basis for developing this set of skills, and to address the content in this grade, Students should perform investigations. As a consequence Students should be able to :
	<p>5.1.1. Evaluate the validity of claims based on the amount and quality of the evidence cited.</p> <p>5.1.2. Explain that predictions can be based on what is known from other experimentation, assuming that conditions are similar.</p> <p>5.1.3. Realize and explain why predictions may be more accurate if they are based on large collections of similar events and how statistical evaluations may inform that accuracy.</p> <p>5.1.4. Determine area and volume of rectangular shapes by covering areas with unit squares, filling volumes with unit cubes, and then making comparisons using linear dimensions and the expressions $A = l \times w$ and $V = l \times w \times h$.</p> <p>5.1.5. Understand how plotting data on a number line helps in seeing where the data lie, including the outliers.</p>
Standard 2 Inquiry	Science is based on Inquiry: as a basis for understanding the concepts of Scientific Inquiry Students should be encouraged to develop their own questions in the context of a Scientific inquiry. Students should be able to :
	<p>5.2.1. Recognize and describe how results of similar scientific investigations may turn out differently because of differences or inconsistencies in methods, materials, and observations, or because of limitations of the precision of the instruments used.</p> <p>5.2.2. Be able to distinguish inferences from actual observations.</p> <p>5.2.3. Write instructions that others can follow to carry out an investigation.</p> <p>5.2.4. Read and follow step-by-step instructions when learning new techniques or engaging in new investigations.</p> <p>5.2.5. Identify the controlled variable and at least one independent variable in a scientific investigation, when appropriate.</p> <p>5.2.6. Explain the distortion inherent in using only a portion of the data collected to describe the whole. Understand that it is sometimes acceptable to discard data if known errors in methodology or observations exist.</p>

Standard 3 Technology	<p>Technology provides tools for Scientific Inquiry: Students should be exposed to technology used in their everyday lives and should use technology where appropriate in their investigations. Students should be able to :</p> <p>5.3.1. Give examples of technology, such as telescopes, microscopes, and cameras that enable scientists and others to gather data and to make observations that would be impossible or impractical with the unaided senses.</p> <p>5.3.2. Give examples of advances in technology that have positively and/or negatively affected society.</p> <p>5.3.3. Give examples of materials not present in nature that have become available because of science and technology, such as cloth, metal alloys, plastic, ceramics, and concrete.</p>
Strand 2	Earth and Space Science
Standard 4 Space Science	<p>Students will be introduced to Space Science: Students should have an appreciation for our solar system and the concept that there are other similar and dissimilar systems in space. Students should be able to :</p>
	<p>5.4.1. Describe that, like all planets and stars, the Earth is approximately spherical in shape.</p> <p>5.4.2. Observe how telescopes are used both to magnify images of distant objects in the sky, including the moon and the planets, and to gather enough light from very dim objects to make them visible.</p> <p>5.4.3. Observe and describe that stars vary in size, but they are so far away that they look like points of light.</p>
Standard 5 Earth Science	<p>Students will be introduced to Earth Science: Students should relate to the earth as a planet in our solar system. Students should be able to :</p>
	<p>5.5.1. Describe the Earth as part of a system called the <i>solar system</i>, which includes the sun (a star), planets, comets, asteroids, and many moons.</p> <p>5.5.2. Recognize that the Earth is the third planet from the sun in our solar system.</p> <p>5.5.3. Demonstrate how the Earth orbits the sun in a year's time, and Earth rotates on its axis about once every 24 hours.</p> <p>5.5.4. Explain that the alternation between day and night and the apparent movement of the sun, moon, and stars across the sky depend on the rotation of the Earth on its axis.</p> <p>5.5.5. Explain that the air around us is matter and has weight (a force) and exerts pressure; explain that air pressure varies a little from place to place and from time to time.</p> <p>5.5.6. Describe that winds blow from areas of higher pressure to areas of lower pressure.</p>

	5.5.7. Explain how global patterns, such as the jet stream and ocean currents, influence local weather and climate in ways that can be measured in terms of temperature, pressure, wind direction and speed, and amounts of precipitation.
Standard 6 Water Cycle	Students will be introduced to the movement of Water through the Water Cycle and develop an understanding of the physical properties of Water: Students should be able to :
	<p>5.6.1. Describe that when liquid water evaporates, it turns into a gas (vapor) mixed into the air, and can condense and reappear as a liquid when cooled or as a solid (ice) if cooled below the freezing point of water.</p> <p>5.6.2. Explain how water moves in air masses from one place to another in the form of clouds, fog, or as invisible water vapor, and falls to the Earth as rain, hail, sleet, or snow.</p> <p>5.6.3. Describe that clouds are made of tiny droplets of water or ice crystals.</p> <p>5.6.4. Explain that water on Earth cycles through different forms and in different locations (e.g., underground water and vapor in the atmosphere).</p> <p>5.6.5. Using maps and globes, recognize that the Earth's oceans are all connected as one body of water that covers about three-quarters of the Earth's surface.</p>
Strand 3	Physical Science
Standard 7 Matter	<p>Students will be introduced to concepts of Matter: Students should be able to :</p> <p>5.7.1. Recognize that all matter is made of small particles called <i>atoms</i>, which are too small to see with our eyes; describe how atoms may combine forming molecules or crystalline solids (compounds).</p> <p>5.7.2. Recognize that there are more than 100 different kinds of atoms (each called an <i>element</i>), which are displayed on the periodic table of the elements.</p> <p>5.7.3. Recognize and explain the differences between elements and compounds and between atoms and molecules.</p> <p>5.7.4. Explain that all matter is made up of an element, a compound, or mixtures of elements and compounds.</p>
Standard 8 Heat and Energy	<p>Students will be introduced to concepts of Heat and Energy: Students should be able to :</p> <p>5.8.1. Describe that heating and cooling cause changes in the properties of substances. For example, liquid water can turn into steam by boiling, and liquid water can turn into ice by freezing.</p> <p>5.8.2. Explain the effect of temperature on the rate of chemical changes (reactions). [The use of refrigeration in slowing decay process is readily available example].</p>

Standard 9 Forces and Motion	<p>5.8.3. Explain that when a warm object and a cool one are placed in contact, heat flows from the warmer object to the cooler one until they are both at the same temperature. Know that heat transfer can also occur at a distance by radiation.</p> <p>5.8.4 Describe how some materials conduct heat much better than others, and poor conductors (insulators) can be used to reduce heat loss or gain.</p> <p>Students will be introduced to concepts of Forces and Motion. Students should be able to :</p> <p>5.9.1. Explain that objects can move with a very wide range of speeds, with some moving very slowly and some moving too quickly for people to see them.</p> <p>5.9.2. Demonstrate that if the forces acting on an object are balanced so that the net force is zero, the object will remain at rest if it is initially at rest or will maintain a constant speed and direction if it is initially moving.</p> <p>5.9.3. Describe that unbalanced forces cause changes in the speed and/or direction of motion of an object (acceleration).</p> <p>5.9.4. Describe that, for an object moving in a straight line, acceleration, a, is the change in velocity, v, divided by the time, t, that change takes ($a = v \div t$).</p> <p>5.9.5. Describe that the greater the net force, F, applied to a body, the greater its acceleration, a. Describe that the greater the mass, m, of an object, the smaller the acceleration produced by a given force.</p> <p>5.9.6. Demonstrate and explain that things on or near Earth are pulled toward Earth's center by the gravitational force that Earth exerts on them.</p>
Strand 4	Life Science
Standard 10 Cell Biology	<p>Students will be introduced to concepts of Cell Biology and appreciate the function of the cell as the smallest unit entity of living organisms. Students should be able to :</p> <p>5.10.1. Describe that some organisms consist of a single cell that interacts with its environment in various ways. Some get their food from the environment (heterotrophs) while others make their own food (autotrophs). Some require oxygen from their environment (aerobes) and other do not (anaerobes). Their waste products are eliminated into the environment.</p> <p>5.10.2. Explain that some organisms are made of a collection of cells that interact with each other in various ways [competition, physiology, and behavior] and with their environment.</p> <p>5.10.3. Explain that in complex organisms such as humans, cells can have a very wide variety of forms and perform very different roles (e.g., nerve cells, muscle cells, and fat cells).</p>
Standard 11 Inheritance	<p>Students will be introduced to concepts of Inheritance in living organisms and learn about the importance of reliable inheritance mechanism in organisms. Students should be able to :</p>

Standard 12
Adaptation and
Survival

5.11.1. Explain why there must be a reliable way to transfer information from one generation to the next **for an offspring to obtain genetic information from each parent. This may result in the offspring having characteristics which resemble those of one of the parents, both parents, or neither parent.**

5.11.2. List some characteristics of plants and animals that are **produced as a consequence of inheritance (genetics) and discuss how that characteristic may be influenced by environment.**

Students will learn about Adaptation and Survival and its importance to the continuity of life. Students should be able to :

5.12.1. Explain that in any particular environment, some kinds of plants and animals survive well, some do not survive as well, and some cannot survive at all.

5.12.2. Identify organisms that are not native to the Washington, DC, area **[e.g., the Zebra mussel, the Snakehead fish, English Ivy, and Hydrilla]** and attributes or characteristics that may influence their chance of survival in the area. **[e.g., lack of natural predators, lack of competition]**

5.12.3. Explain **that though all organisms interact with their environment in various ways and consequently can create changes in that environment, humans can cause deliberate changes in their environment and these changes may affect the ecosystem (the living and nonliving components of the environment).[e.g., the consequences of a beaver creating a dam versus humans creating a dam].**

5.12.4. Explain that **certain forms within a diverse group of organisms may have a reproductive advantage in a particular environment. Typically this group will produce more viable offspring and over time, the inherited characteristics of this group will become predominant in the population (e.g., shape of beak, length of neck, shape of teeth, and form of flower).**

5.12.5. Explain how changes in an organism's habitat are sometimes beneficial and sometimes harmful, and how changes in the environment (drought, cold) have caused some plants and animals to die, migrate, or become extinct.

5.12.6. Explain that many plants and animals can survive harsh environments because of **certain physiological, structural, or behavioral differences** (e.g., in winter, some trees shed leaves, some animals hibernate).

5.12.7. Recognize that some animal behaviors are instinctive **[not learned]** (e.g., turtles burying their eggs, human infants crying when hungry) and others learned (e.g., a wolf's hunting skills, humans' ability to build fires for warmth).

5.12.8. Describe well-defined plant behaviors, such as the way seedlings' stems grow toward light and their roots grow downward **as a consequence of gravity.**

5.12.9. Examine the information **that can be learned from the study of fossils that in turn provides knowledge about living things that inhabited the Earth in the distant past. Describe how fossils can be**

compared both to one another and to living organisms according to their similarities and differences.

5.12.10. Recognize and describe how artifacts and preserved remains provide some evidence of the physical characteristics and possible behaviors of human beings and their ancestors who lived long ago.